Permit limits are derived from calculations using formulas contained in USEPA, 1991(Technical Support Document for Water Quality-Based Toxics Control, EPA/505/2-90-001) and dilution values were obtained from the permit writer, Sara Greiner. Prepared by Amy Wagner, R9 Lab, on 7/26/07.

EFFLUENT PERMIT LIMIT CALCULATION FOR AMERICAN SAMOA CANNERIES

1. Wasteload allocation calculation at edge of mixing zone (from oil platform NPDES permit)

$Co = (Ce + DmCs)/(Dm + 1)$, thus

$$1 = \frac{Ce + (313)(0)}{(313+1)}$$

$Ce = 314$ TUc

where Ce = the end-of-pipe effluent concentration (chronic wasteload allocation in toxic units)
Co = Concentration at the edge of the mixing zone (chronic toxic units)
Dm = critical dilution ratio expressed in parts seawater per part wastewater
Cs = background seawater concentration

For canneries, the dilution value is 313:1
The chronic toxic units Co = 1 according to the NPDES permit
The background concentration Co = 0 according to the NPDES permit

2. Chronic 4-day Average (Table 5-1, USEPA, 1991)

$$LTAc = WLAc \bullet e^{[0.5\sigma_4^2 - z\sigma_4]}$$

where LTAc = Chronic long-term average wasteload
WLAc = chronic wasteload allocation in toxic units (Ce calculated in 1)
$e^{[0.5\sigma_4^2 - z\sigma_4]}$ = wasteload allocation multiplier

Assumptions based on NPDES permit:
Coefficient of Variation (CV) = 0.6
Percentile level = 99th percentile

$LTAc = (314)(0.527) = 165.48$ TUc

3. Maximum Daily Limit (Table 5-2, USEPA, 1991)

$$MDL = LTAc \bullet e^{[z\sigma - 0.5\sigma 2]}$$

where MDL = maximum daily limit
LTAc = Chronic long-term average wasteload
$e^{[z\sigma - 0.5\sigma 2]}$ = wasteload allocation multiplier

Assumptions based on NPDES permit:
Coefficient of Variation (CV) = 0.6
Percentile level = 99th percentile

$MDL = (165.48)(3.11) = 514.64$ TUc

4. Translating the maximum daily trigger to a permit limit in terms of % effluent (p. 6, USEPA, 1991)

$$NOEC = \frac{100}{TUc}$$

NOEC =No Observed Effect Concentration, the highest tested concentration of an effluent or a toxicant at which no adverse effects are observed on the aquatic test organisms at a specific time of observation.

TUc = Toxic Unit Chronic is the reciprocal of the effluent concentration that causes no observable effect on the test organisms by the end of the chronic exposure period.

$$NOEC = \frac{100}{514.64} = 0.194\% \text{ effluent}$$

5. Average Monthly Limit (Table 5-2, USEPA, 1991)

$$AML = LTAc \bullet e^{[z\sigma n - 0.5\sigma n2]}$$

where AML = average monthly limit
LTAc = Chronic long-term average wasteload
$e^{[z\sigma n - 0.5\sigma n2]}$ = wasteload allocation multiplier

Assumptions based on NPDES permit:
Coefficient of Variation (CV) = 0.6
Sample size (n) = 4
Percentile level = 95^{th} percentile

AML = (165.48) (1.55) = 256.49 TUc

6. Translating the average monthly trigger to a permit limit in terms of % effluent (p. 6, USEPA, 1991)

$$NOEC = \frac{100}{TUc}$$

NOEC =No Observed Effect Concentration, the highest tested concentration of an effluent or a toxicant at which no adverse effects are observed on the aquatic test organisms at a specific time of observation.

TUc = Toxic Unit Chronic is the reciprocal of the effluent concentration that causes no observable effect on the test organisms by the end of the chronic exposure period.

$$NOEC = \frac{100}{256.49} = 0.390\% \text{ effluent}$$